DOCUMENT RESUME

ED 470 908 PS 030 778

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TITLE	Young Children's Initial Exploration of Computers.
PUB DATE	2000-11-00
NOTE	9p.; In: Issues in Early Childhood Education: Curriculum, Teacher Education, & Dissemination of Information. Proceedings of the Lilian Katz Symposium (Champaign, IL, November 5-7, 2000); see PS 030 740.
AVAILABLE FROM	For full text: http://ericeece.org/pubs/books/katzsym/graham.pdf.
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	*Computer Uses in Education; Developmental Stages; Early Childhood Education; *Preschool Children; Sex Differences; Teaching Methods

ABSTRACT

This 1-year qualitative study collected observational and interview data on 12 preschool children concerning their initial computer use. Children had the choice to use a computer during center time in their preschool. Findings indicated that initial computer use with a mouse was found to occur at approximately 36 months. Some possible gender differences were noted. Girls tended to use the computer as a shared social activity, while boys tended to use the computer more as a solitary game. Children approached the computer in the same way as they approach puzzles and other fine motor activities. Children were drawn away from the computer by open-ended creative activities. The time that children spent on the computer increased with age, but the time periods were not excessive, from 5 to 20 minutes. Children tended to spend longer at the computer in the presence of an adult. They often assumed a slouch typical of college students in a computer lab. Based on findings, it was recommended that computer use by preschool children be studied more thoroughly before decisions about early computer use are made. (Contains 13 references.) (Author/HTH)

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Young Children's Initial Exploration of Computers

Mary Jo Graham & Steven R. Banks

Abstract

This study presents the results of a one-year qualitative study. Observational and interview data were collected on 12 preschool children concerning their initial computer use. Children had the choice to use a computer during center time in their preschool. Initial computer use with a mouse was found to occur at approximately 36 months. Some possible gender differences were noted. Girls tended to use the computer as a shared social activity. Boys tended to use the computer more as a solitary game. Children approached the computer in the same way as they approach puzzles and other fine motor activities. Children were drawn away from the computer by open-ended creative activities. The time that children spent on the computer increased with age, but the time periods were not excessive, from 5 to 20 minutes. Children tended to spend longer at the computer in the presence of an adult. They often assumed a slouch typical of college students in a computer lab. Implications of this early computer use are discussed with the recommendation that computer use by preschool children be studied more thoroughly before decisions about early computer use are made.

The introduction of the personal computer into the daily lives of families and into the classrooms of young children presents possibilities and concerns about the benefits of computers for preschool children. In the 1980s, computer use focused on learning computer languages and programming skills. In the 1990s, the growth of "user-friendly" personal computers, along with the growth of the Internet, changed the nature of computer use. Emphasis on computer languages lessened as software programs became self-explanatory. Children and adolescents fearlessly embraced the new possibilities presented by computers. Many elementary and secondary students are now adept at using computers, often more so than their parents and teachers.

As the use of computers at home and in schools grows, younger children are exposed to computers and are naturally curious about computers. Parents frequently tell about the interest that their preschool children have in computers. Endorsed by media, beliefs proliferate among many parents and educators that computers are highly important to the education of young children and their later success (Guernsey, 2000). Children without computers at home and school are often viewed as disadvantaged. Preschools capitalize on this view and advertise the availability of computers to entice parents to enroll children. However, little research has explored the ability of the computer to improve upon current educational methods in the preschool years. In addition, little research has focused on the beginning processes of computer awareness and skill development, and long- and short-term benefits of early use.

On the other hand, some early childhood educators believe that computers are actually pushed into the curriculum by overly zealous educators and demanding parents who are unwisely insisting upon computer skills prior to school entry. As computers have gained access to homes and classrooms, concerns among some early educators have increased. Reports of children spending endless hours on a computer avoiding needed exercise and play abound. Computers have been blamed for homework interference, lack of sleep, and increased obesity. Some early childhood educators are so concerned about computer use that they refuse to integrate computers into their classrooms. One author proposed that computers are inappropriate before the age of 7 (Healy, 1999).

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As noted, a paucity of research limits the ability to determine which group of parents and early educators is correct. Some research has indicated that kindergarten children can learn certain basic computer skills (Jones, 1998; Kajs, Alaniz, Willman, & Sifuentes, 1998; Landerholm, 1994). Other research has indicated that, with increased exposure to computers, elementary students show increasingly more positive attitudes toward computers (Miyashita, 1994). Some research has indicated that gender differences remain in attitudes about and use of computers among both primary and secondary students (Bannert & Arbinger, 1996; Kinnear, 1995). However, other research has indicated that gender differences were not apparent in the primary grades (Landerholm, 1994).

One of the few studies on preschool children was completed by Fletcher-Finn and Suddendorf (1997). This study examined the effects of an intervention procedure that involved placing a computer in a home for a period of two and a half months. Pre- and post-tests were conducted comparing matched intervention and control groups on certain cognitive measures. While no significant differences were noted on the cognitive outcome measures, there were some interesting ancillary findings. Children spent an average of 1.5 hours per week on the computer. A minimum number of seven to eight computer interactions occurred per week, with an average session lasting about 12 minutes. In a 1996 study, Fletcher-Finn and Suddendorf stated that "computer use in young children appears to accelerate the natural development of representational ability which forms the basis of mature social interaction and the conception of self through time" (p. 110).

This paper examines initial computer use with an attempt to ascertain a typical age norm. We also examine gender differences, attitudes toward computer use, and average use time for individual computer sessions.

Method

Participants

Participants in this study were 12 preschool students, 7 boys and 5 girls. In addition, one of the parents of each child in the study was interviewed. The children's families were economically diverse. At the time the study was initiated, the children's ages ranged from 29 months to 58 months. The mean age of the children was 41 months (3 years and 5 months).

Materials

A guided observation record and a parental interview questionnaire were developed to determine initial computer use among the participants. Both the observational procedure and the parental interview were designed to answer the following research questions:

- At what age can a child appropriately use the mouse to control the computer program?
- Does computer use vary by gender?
- How do preschoolers initially approach the computer?
- How do preschoolers view the computer?
- How long do children use the computer in one single sitting?
- What are the ergonomic aspects of preschoolers' computer use?

Design and Procedure

The design of this study was qualitative, with two components: observations and parental interviews. Observations were completed both through a one-way observation booth and in the classroom at a university laboratory preschool. While the subjects noticed the observers, their presence did not appear to have much effect on the behavior of the subjects. The observers remained passive unless approached by a child when in the classroom. Very little difference in behavior was noted during concealment versus during participant observation. This result may be due to the large numbers of student teachers and parents who come and go in the preschool. In addition to the two authors, two observers were trained to note a series of characteristics that focused on computer usage.

A single computer was placed on the smallest computer table available at one side of the classroom. The table was placed between the dramatic play area and the block area. Two child-sized chairs were

placed at the computer table. More chairs were easily available and were moved to the area as needed. The computer was available to children during center time and was turned off when the children engaged in large-group activities. The keyboard was set aside, and only the mouse was made available for the participant's use.

The opportunity to use computers during center time rather than at an assigned time is posited by several authors as best for young children (Haugland, 2000; Hohmann, 1990). This policy was adopted by the preschool for this study. The software selected offered the children a group of pictures from which they could select an activity by clicking on the picture with a mouse. Once the children selected the activity, they used the mouse to participate. A variety of software selections were available on the computer. These included making up songs; playing rhythms by striking percussion instruments; responding to verbal descriptions of characters and selecting the one character that matched the description; and electing designs, colors, and animated effects to create pictures.

Results

The first research question posed by the authors concerns the effective date of initial computer use. As defined by the researchers, this date is when the participants can make the connection between moving the mouse and controlling the cursor. Thus, when the child can successfully move the cursor to a desired position, she can be said to have an effective date for initial computer use. Both the parental survey questionnaire and the classroom observations indicate that the average effective date for initial computer usage is approximately 36 months. Clearly some variation occurs in initial computer use, although no parents reported an initial age more than one or two months before a child's third birthday.

The manner in which children made this connection of mouse and cursor varied as well. Most children began by moving the mouse wildly in circles while watching the screen as if believing that the more energy expended the more likely they were to accomplish the task. However, a teacher would typically put her hand over the child's hand and slow the action down while pointing to the cursor on the screen. With two or three brief sessions of teacher scaffolding and much watching of other children, most children seemed to have the concept of slow deliberate movement of the hand. They would then focus on the cursor specifically rather than the pictures on the screen and worked very deliberately to get the cursor to the desired place. One child put his left hand on the screen and attempted to push the cursor while slowly moving the mouse back and forth.

The second research question asked about the variation in computer use by gender. Neither the survey questionnaire nor the observations indicated any differences in overall computer use by gender. Age, rather than gender, played the major role in determining the extent of computer use. Observations indicated that girls appeared more likely to socialize with other children while using the computer. In effect, they more often worked with another child and were more likely to engage in cooperative play with other children at the computer. Boys appeared slightly more likely to engage in solitary play with the computer.

The third question asked how the children approached the computer initially. In many respects, the children approached the computer in the same way that they approached other learning centers at the preschool. They were neither overly excited by the computer, nor did they ignore it. Children seemed to respond to the computer as they did to puzzles in the fine motor center. The children's times were short, most often 5 to 10 minutes at the computer. These times were similar to the times children spent at the fine motor table. If a teacher actively interacted with the children at the computer or the fine motor table, the children tended to stay at these centers longer. In fact, if a teacher were present, lines of children waiting to play the computer would sometimes form.

The fourth question addressed how preschoolers viewed or defined the computer. One of the participants initially stated that a "computer was what Daddy worked on." Another child indicated a similar attitude. However, in general, the children viewed the computer as a toy or a game; they saw it as similar to a Nintendo game. One of the children started to act out typing on the keyboard. Another child made the

connection between the computer CD and CDs in the store. According to the parent interview, this child now wants to buy every CD that he sees.

The fifth question addressed the issue of how long children used the computer in one single sitting. In general, they used it for a relatively short time, with this factor apparently age dependent. Use time varied between 5 and 10 minutes. With several of the older children, individual computer time reached 15 to 20 minutes. Again, age was the prime predictor of length of use. During heavy use periods when lines of children were waiting to use the computer, the teachers would use a timer, set at 5 to 7 minutes. None of the participants seemed particularly "addicted" to the computer. In nearly every case, the participants treated the computer like any other learning center.

The sixth question addressed the ergonomic aspects of computer use. Slouching and poor posture were noted during computer use. One observer noted that two of the children virtually had their noses touching the screen. Observers' reports indicated a lot of fingers touching the screen. Because of the nature of the computer station, nearly all the children had to look up to the screen. This position did result in hyperextension of the neck. Most of the children also had to raise their arms to deploy the mouse.

Discussion

Rogoff (1990) describes the engagement of children and caregivers in the process of guided participation as they develop the skills and understandings necessary for participation in their social world. Today's teachers and parents have learned about computers as adults and did not experience guided participation as children. With this insufficient history to guide caregivers in developing mutual understandings with children about computers, it is understandable that discomfort and controversy surround the use of computers with young children.

Computers are a new tool of our social world. Just as the invention of refrigeration and the range changed the way we cook and the automobile changed the organization of our urban areas, the computer has the ability to change the way we organize and access information, communicate, conduct business, maintain records, and entertain ourselves. The introduction of a new tool creates a period of uncertainty as we learn to make that tool a part of our daily lives. It is perhaps that period of uncertainty that we are now experiencing. Some fear the new tool, particularly in the hands of young children; others wholeheartedly embrace the tool. However, if the computer is ever to be understood for its potential benefits and evils, rational and systematic exploration of the impact of the computer on young children's experiences both for the short and long term is required. Research must identify the consequences of computers in the early years so that judicious constructive utilization can be made of this new tool.

In making the decision to include computers in a laboratory preschool, research literature was scrutinized to help make a determination of the potential long- and short-term benefits for young children. In addition, information was sought about the age at which children demonstrated sufficient fine motor, perceptual, and cognitive competency to use a computer. The needed information was simply unavailable. It is important to know if developmental patterns are altered for young children and how these alterations may affect the quality of life as children mature. A broader base of knowledge was needed by the preschool to make truly wise choices about the use of computers in the classroom.

What does exist in the research literature is a collection of articles about the developmental appropriateness of particular software and ways of including computers in the classroom (Haugland, 2000; Hohmann, 1990). The literature suggests a wholehearted acceptance of computer use, but is this acceptance justified? Little documentation about when and how children can typically use computers with competence is available. The impact of computer use in the preschool years is not measured. It would seem logical that learning to use a mouse would have some impact on fine motor and perceptual development patterns and that the use of this new medium could have an impact on cognitive development. With few exceptions, research focused on preschool children has not explored these areas to any great extent. Extensive research to inform parents and early childhood educators about the

impact and outcomes of early computer use is needed.

Because of the lack of information, the laboratory school personnel made the decision to introduce the computer to the classroom and systematically document children's use. Once the necessary hardware was obtained, the greatest challenge was software selection, particularly avoiding software that introduced letters and numbers. The school personnel regard introduction of letters to be premature and first introduce written language as a whole. In addition, the preschool teachers wanted software that allowed children to have many creative choices. Very few software programs met these requirements.

The first question posed by the authors concerned the effective date of initial computer use. While 36 months was the average, the small sample size of 12 children certainly limits the ability to generalize. Whether age of accomplishment is linked to social and environmental factors, cognitive development, or motor and perceptual development is still to be determined. Designating the age of 3 as the age of initial computer competence is subject to the same criticism that all norms and milestones encounter.

The manner in which children made the connection of mouse and cursor and learned to control the cursor through the mouse varied as well. Scaffolding by the teachers clearly played a role in the development of the ability to use the mouse. Teachers assisted the children by developing the feel for mouse movement with hand-over-hand movement and drew their attention to the tiny cursor on the screen. Children may be able to accomplish this skill on their own at a later age, but the scaffolding allowed the children to learn the skill earlier.

It appears possible to teach children to use a computer at an early age. However, this ability does not answer the question of the appropriateness of learning to use a mouse at 3 rather than waiting until children have taught themselves a few years later. Because a child can learn something at a particular age does not necessarily mean that it is appropriate for a child to do so. The process of figuring out how to use the mouse is essentially different from instructing a child to use a mouse. Does a child gain certain benefits from solving problems on her own that are lost by instructing the child? Further study comparing both short- and long-term outcomes of the self-taught child with the instructed child could help clarify this issue and provide guidance to the early educator.

The preschool did not place the keyboard within easy reach of the children. Only the mouse was readily available. The children did not express interest in letters, and therefore the keyboard seemed to be irrelevant. However, as the school year progressed, several of the children were attempting to write their names. Therefore, the keyboard was placed so as to encourage use. The children continued to use the mouse. Because one child in the room was blind, large printed uppercase letters with raised Braille letters were put on each key. However, this labeling did not create any additional interest. The lack of interest in letters seemed appropriate for the age of the children. Much of the software advertised for preschool use focuses on learning letters. These software packages seem mislabeled.

The second question explored differences among children by gender and age. Slight gender differences were observed, but these differences may have more to do with a child's general temperament or dispositions than with gender. Again, the small sample prevents generalization. The girls who were more social in their use of computers may well be more socially disposed. Age, social development, and temperament type would need to be controlled in an investigation of gender differences in the early years. It would also be helpful to look at who uses the computer and what they do with the computer in the child's world outside school. If the child is accustomed to seeing a male or female person using a computer in a particular way, the child may well develop beliefs about the way that a computer should be used by a particular gender.

The third question focused on the way that children initially approached the computer. The children tended to approach the computer as they would the puzzle and fine motor center. If a teacher was present, lines of children wanting computer time tended to form. If an observer who appeared disinterested in the computer was nearby or if no adult was nearby, the children's interest was not as great.

This behavior is similar to how the children approached the fine motor center, suggesting that the computer is a place where children seek to connect with adults. This observation raises the question about children's real interest. Are children interested in computers because adults express a fascination with them and children want to connect with adults?

During the semester, the computer was moved from the wall between centers into the housekeeping center. The majority of the parents indicated that the children had seen a computer in the household. School personnel surmised that because the computer is a tool in the home similar to the telephone, refrigerator, and microwave, that children may include the computer in their imaginative play. However, the computer simply got in the way of imaginative play. The children continued to use the computer as a fine motor activity and did not incorporate the computer into dramatic play. It was noted that in the children's homes, computers are not located in the active part of the home but rather are tucked away in a study or corner of a room. Children do not see them as a central part of family activity; family members may be more likely to retreat to use computers.

On one occasion, the children organized the chairs and steering wheels of the entire classroom into a giant vehicle to go to the beach. (Most children in the school spend a week of vacation in their family vans traveling to the beach.) Therefore, this activity was exciting to a majority of the group. The children gathered almost all of the materials in the block, fine motor, and dramatic house play areas into their vehicle. They ignored the computer. The only use the computer had that day was from the few children who did not join the trip to the beach.

Perhaps the most interesting incident involving the computer was the day that a bag of pea gravel was dumped on the floor in the area next to the blocks and vehicles. For six mornings of school, not one child used the computer. In fact, all of the children played with the pea gravel. At first, the pea gravel was used entirely with the trucks, but by the third morning, children were incorporating pea gravel into their household play and fine motor play. With such an engaging new open-ended material, children were not at all interested in the computer. This behavior further supports the possibility that children's primary interest in the computer is to understand adults' fascination with the tool and perhaps to learn to control the pictures in a way that television cannot be controlled. After all, a developmental goal of young children is to understand and control their environment. Considering the reaction of the children, computers do not seem to be a high priority of the children, particularly when more creative open-ended materials are available.

The fourth question asking how children viewed the computer indicated that their previous experiences play a role. In addition to being used as a fine motor activity similar to a puzzle, several other uses by individual children were noted. One child used the computer to separate from his mother in the morning. The child and the mother sat at the computer for about 5 minutes doing one of the activities before the child was willing to bid his mother farewell. The few children who at cleanup time would busy themselves at the computer while the others cleaned up demonstrated another use. Once the tactic was pointed out to student teachers, the computer was turned off at the beginning of cleanup, and the escaping children were engaged in the cleanup process.

The fifth question addressed the issue of how long children used the computer in one single sitting. Generally, activities that required the child to create or choose were most popular, and children spent longer with these activities than with the activities requiring children to match requests of the computer. Children who were older used the computer for longer periods of time.

Excessive time at the computer was not observed. When the children had the choice of a wide variety of classroom activities, particularly open-ended creative activities, children were brief in their computer use. Reports of children using computers for extended periods raise questions about the choices available to children during these extended periods of use. Environments with uninteresting or limited choices may be fostering the misuse of computers by children, and this possibility is worth further study.

The sixth question explored the ergonomic aspects of computer use. The positioning of children at the

computer raised some concern. Although the smallest computer table available through catalogs was selected, all but the tallest children looked up to the screen. This position hyperextends the neck. Children should be positioned so that they look straight at the computer or with their head turned down slightly. In addition, arms should fall relaxed from the shoulder with a 90-degree bend at the elbow (K. Kittusamy, personal communication, 2000). Most of the children had to raise their arm to reach the mouse. If children were placed on a higher chair to accommodate the proper positioning, their feet could not touch the floor.

Ergonomic factors may present one of the more troubling aspects of initial computer use. While children are not spending time in these positions to the extent that damage would occur, it is allowing children to grow accustomed to habits that are not healthy in the long term. Further work needs to be done in designing furniture if children are going to use computers. It would be wise to have tables that can be raised and lowered easily to adapt to the varying heights of children. Also a concern was children who moved their noses close to the screen. This position raises concern about potential visual problems that may need to be studied more closely.

Conclusions

Information is very limited on the impact of computers in the lives of young children. Not only is more information needed to assess the worth of computers in the early childhood setting, but if computers are deemed worthy for young children, more information is needed on how best to introduce computers to young children and how best to utilize computers at home and in the classroom. More research must be conducted to inform early childhood educators.

This study with a small group of preschool children found that children successfully learn to manipulate the cursor with the mouse at 3 years of age. Teachers were able to assist the children in gaining expertise with hand-over-hand scaffolding. Children in this group were quite neutral to computers, using them briefly much the same way they use puzzles. Children preferred more open-ended activities that required their input both in the classroom and on the computer. Children also used computers to make transitions and to connect with adults. The children did not include the computer in their imaginative play. Children were disinterested in the keyboard except to imitate a typing behavior. Gender differences were noted but were difficult to interpret.

The time that children spent with the computer was related to age. The youngest children often spent less than 5 minutes at the computer, while the older children would sometimes sit at the computer for 20 minutes. This length of time did not seem to limit the children's experiences with other materials and activities in the classroom. The greatest concern focused on the poor posture that children maintained. The furniture limited the ergonomically sound placement of children at the computer. The potential for development of poor habits in the long term must be considered. Another concern was noted in the selection of software. Much of the software labeled for preschool use seemed inappropriate.

Certainly, much needs to be learned before it is possible to wholeheartedly endorse or limit computer use in the early years. Because computers are increasingly available to children at home and at school and they are becoming much easier to use, it is wise to thoroughly research computer use beginning in the early years.

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EFF-088 (Rev. 9/97)